DATA SHEET

BF547W
NPN 1 GHz wideband transistor

Product specification
Supersedes data of November 1992
File under Discrete Semiconductors, SC14

June 1994

Philips Semiconductors

PHILIPS

NPN 1 GHz wideband transistor — BF547W

FEATURES

- Stable oscillator operation
- High current gain
- Good thermal stability.

APPLICATIONS

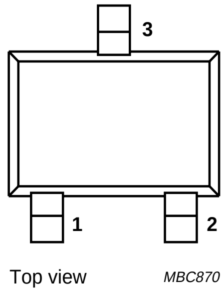
It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 (S-mini) package. The BF547W uses the same crystal as the SOT23 version, BF547.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Marking code: E2.

Fig.1 SOT323

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
I_C	collector current (DC)		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 63 °C; note 1	–	–	300	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C	–	20	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	50	mA
P_{tot}	total power dissipation	up to T_s = 63 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

Note to the “Quick reference data” and “Limiting values”

1. T_s is the temperature at the soldering point of the collector pin.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 63 °C; note 1	290	K/W

Note

1. T_s is the temperature at the soldering point of the collector pin.

CHARACTERISTICS

T_j = 25 °C (unless otherwise specified).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.01 mA; I_E = 0	–	–	30	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA; I_B = 0	–	–	20	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.01 mA; I_C = 0	–	–	3	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
G_{UM}	maximum unilateral power gain; note 1	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C;	–	20	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero. $G_{UM} = 10\ \log\frac{|s_{21}|^2}{(1-|s_{11}|^2)\ (1-|s_{22}|^2)}$ dB.

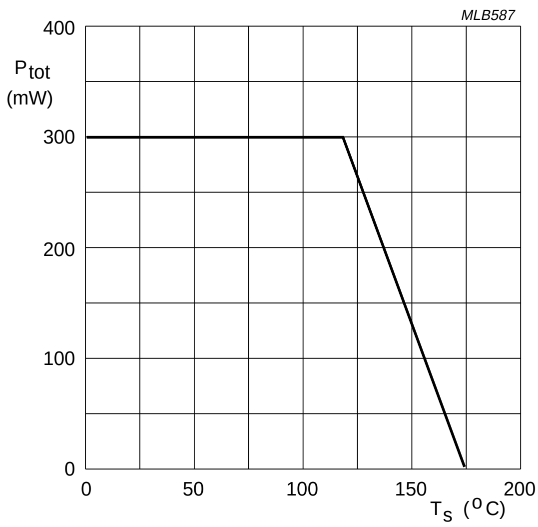
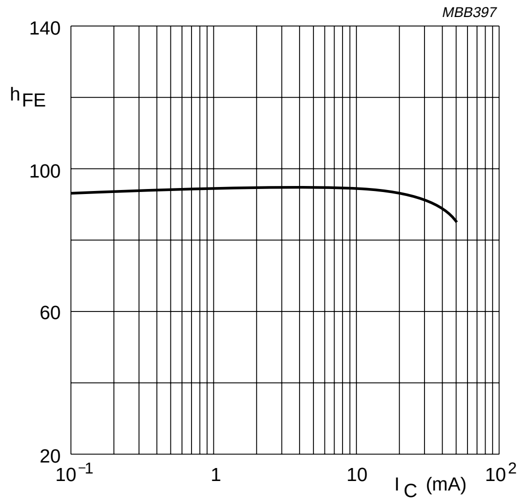
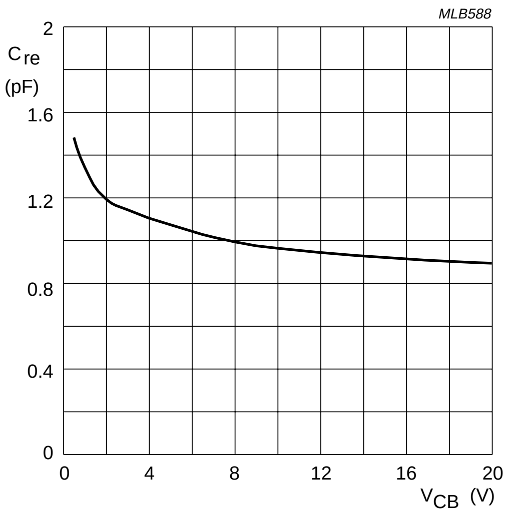


Fig.2 Power derating curve.



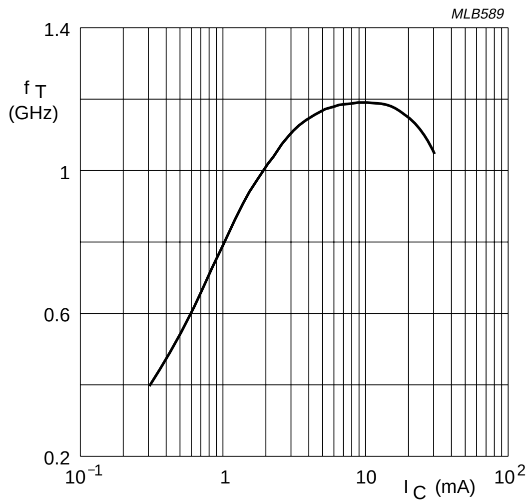
V_{CE} = 10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current; typical values.



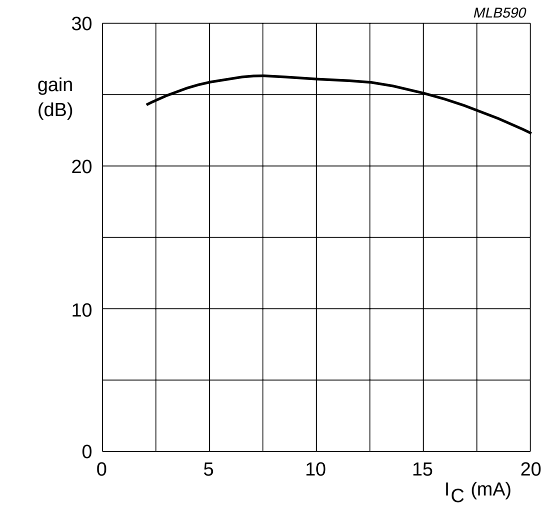
I_C = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage; typical values.



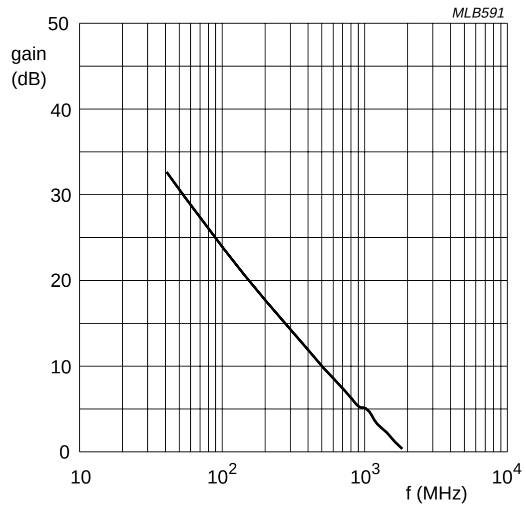
V_{CE} = 10 V; f = 500 MHz.

Fig.5 Transition frequency as a function of collector current; typical values.



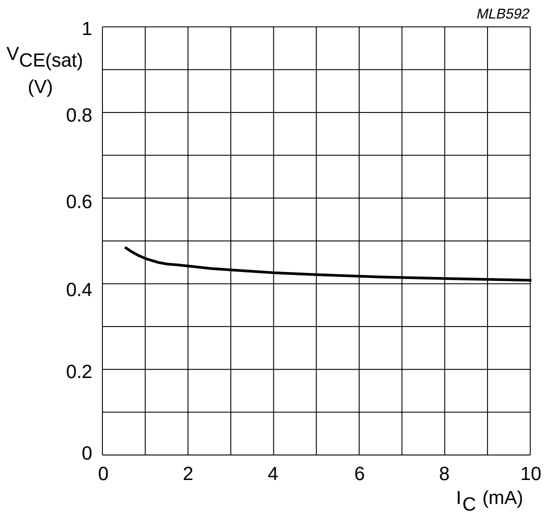
V_{CE} = 10 V; f = 100 MHz.

Fig.6 Gain as a function of collector current; typical values.



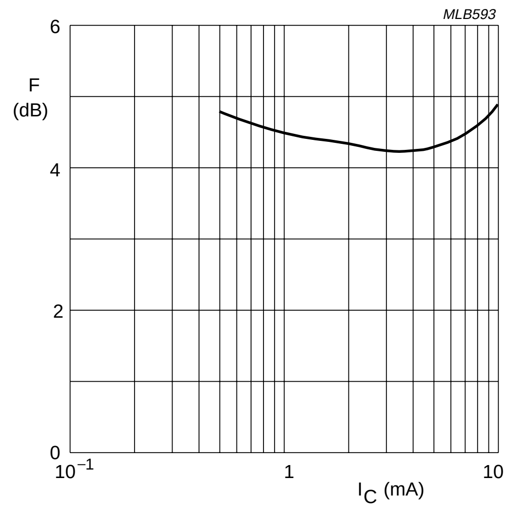
V_{CE} = 10 V; I_C = 15 mA.

Fig.7 Gain as a function of frequency; typical values.



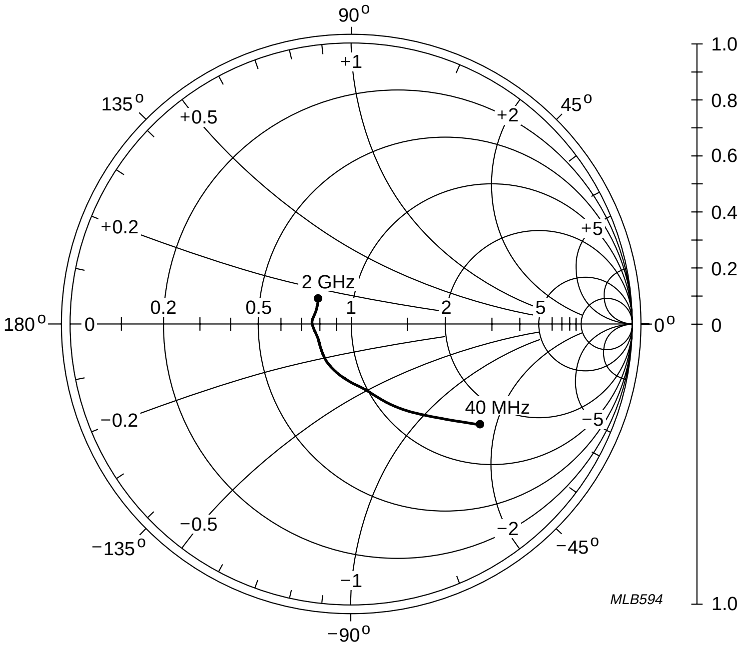
I_C/I_B = 10.

Fig.8 Collector-emitter saturation voltage as a function of collector current; typical values.



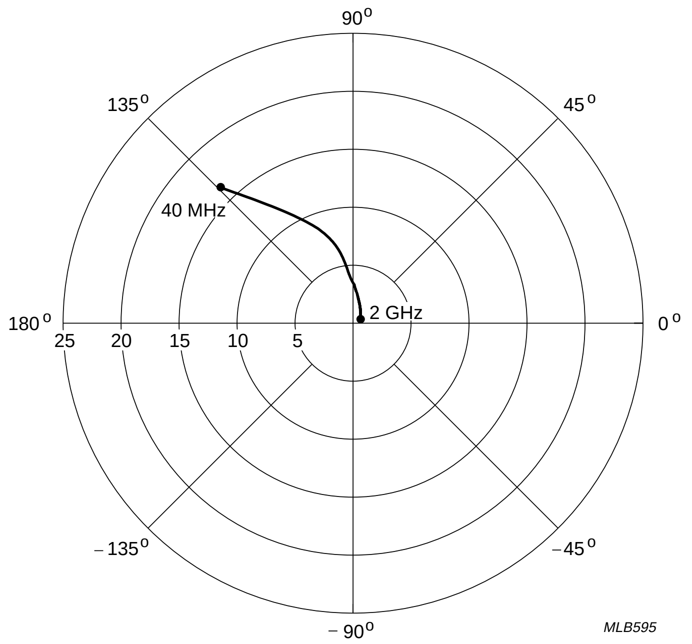
V_{CE} = 10 V; Z_S = Z_L = 50 Ω; f = 100 MHz.

Fig.9 Minimum noise figure as a function of collector current; typical values.



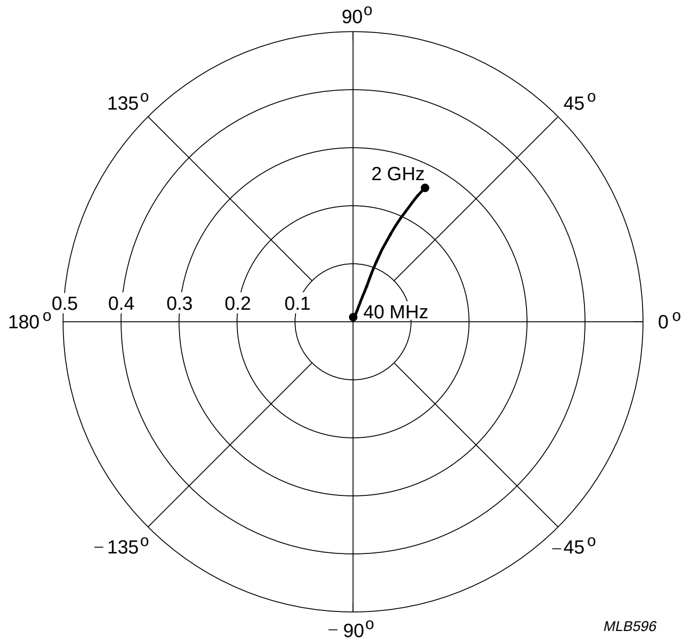
V_{CE} = 10 V; I_C = 15 mA; Z_o = 50 Ω.

Fig.10 Common emitter input reflection coefficient (s_{11}); typical values.



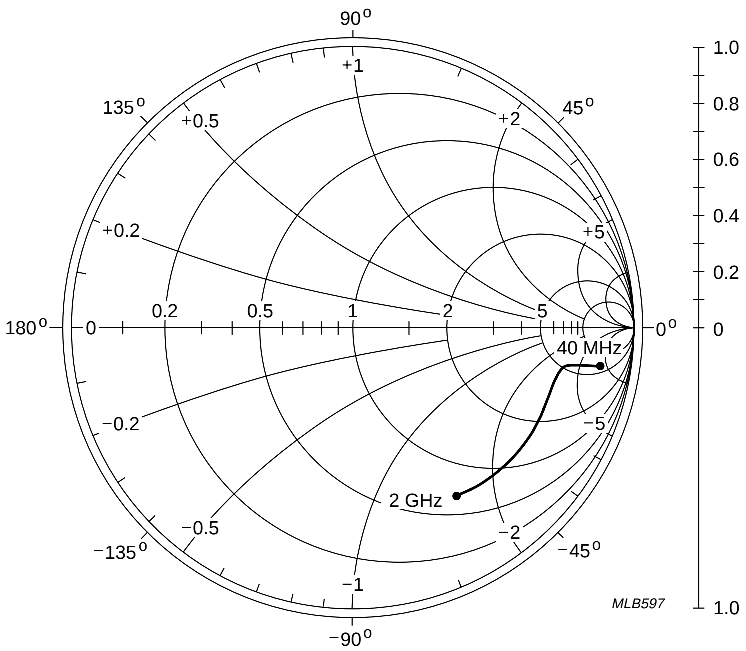
V_{CE} = 10 V; I_C = 15 mA.

Fig.11 Common emitter forward transmission coefficient (s_{21}); typical values.



V_{CE} = 10 V; I_C = 15 mA.

Fig.12 Common emitter reverse transmission coefficient (s_{12}); typical values.



V_{CE} = 10 V; I_C = 15 mA; Z_o = 50 Ω.

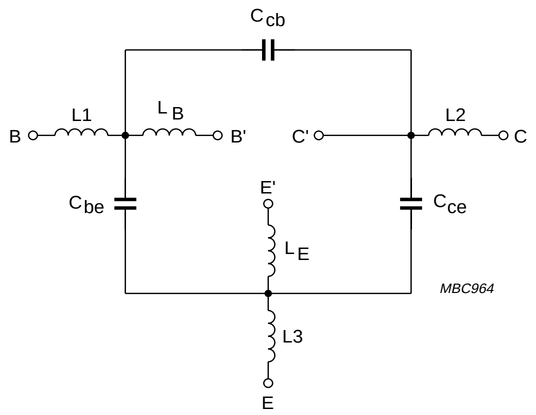
Fig.13 Common emitter output reflection coefficient (s_{22}); typical values.

SPICE parameters for the BF547W crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	289.1	aA
2	BF	94.29	–
3	NF	0.989	–
4	VAF	90.00	V
5	IKF	158.6	mA
6	ISE	426.6	aA
7	NE	1.491	–
8	BR	12.32	–
9	NR	0.989	–
10	VAR	19.39	V
11	IKR	24.75	mA
12	ISC	249.7	pA
13	NC	1.200	–
14	RB	50.00	Ω
15	IRB	1.000	μA
16	RBM	50.00	Ω
17	RE	0.500	Ω
18	RC	1.309	Ω
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	1.071	pF
23	VJE	727.3	mV
24	MJE	0.332	–
25	TF	92.98	ps
26	XTF	43.89	–
27	VTF	1.813	V
28	ITF	143.9	mA
29	PTF	0.000	deg
30	CJC	1.167	pF
31	VJC	489.0	mV
32	MJC	0.253	–
33	XCJC	0.150	–
34	TR	50.00	ns
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.950	–

Note

1. These parameters have not been extracted, the default values are shown.



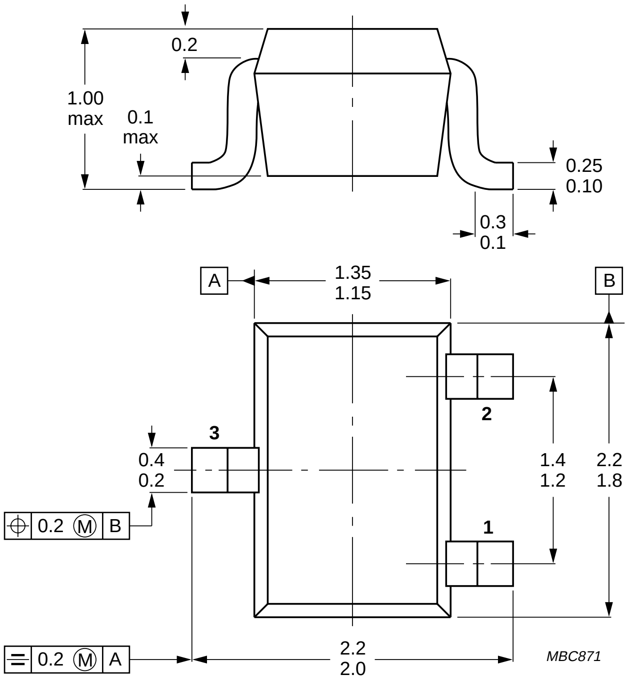
QL_B = 50; QL_E = 50; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/f_c)}$;
f_c = scaling frequency = 100 MHz.

Fig.14 Package equivalent circuit SOT323.

List of components (see Fig.14).

DESIGNATION	VALUE	UNIT
C_{be}	2	fF
C_{cb}	100	fF
C_{ce}	100	fF
L1	0.34	nH
L2	0.10	nH
L3	0.34	nH
L_B	0.60	nH
L_E	0.60	nH

PACKAGE OUTLINE



Dimensions in mm.

Fig.15 SOT323.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

NOTES

NOTES

Philips Semiconductors – a worldwide company

Argentina: IEROD, Av. Juramento 1992 - 14.b, (1428)
BUENOS AIRES, Tel. (541)786 7633, Fax. (541)786 9367
Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113,
Tel. (02)805 4455, Fax. (02)805 4466
Austria: Triester Str. 64, A-1101 WIEN, P.O. Box 213,
Tel. (01)60 101-1236, Fax. (01)60 101-1211
Belgium: Postbus 90050, 5600 PB EINDHOVEN, The Netherlands,
Tel. (31)40 783 749, Fax. (31)40 788 399
Brazil: Rua do Rocio 220 - 5th floor, Suite 51,
CEP: 04552-903-SÃO PAULO-SP, Brazil.
P.O. Box 7383 (01064-970).
Tel. (011)821-2327, Fax. (011)829-1849
Canada: INTEGRATED CIRCUITS:
Tel. (800)234-7381, Fax. (708)296-8556
DISCRETE SEMICONDUCTORS: 601 Milner Ave,
SCARBOROUGH, ONTARIO, M1B 1M8,
Tel. (0416)292 5161 ext. 2336, Fax. (0416)292 4477
Chile: Av. Santa Maria 0760, SANTIAGO,
Tel. (02)773 816, Fax. (02)777 6730
Colombia: IPRELENSO LTDA, Carrera 21 No. 56-17,
77621 BOGOTA, Tel. (571)249 7624/(571)217 4609,
Fax. (571)217 4549
Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,
Tel. (032)88 2636, Fax. (031)57 1949
Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. (9)0-50261, Fax. (9)0-520971
France: 4 Rue du Port-aux-Vins, BP317,
92156 SURESNES Cedex,
Tel. (01)4099 6161, Fax. (01)4099 6427
Germany: PHILIPS COMPONENTS UB der Philips G.m.b.H.,
P.O. Box 10 63 23, 20043 HAMBURG,
Tel. (040)3296-0, Fax. (040)3296 213.
Greece: No. 15, 25th March Street, GR 17778 TAVROS,
Tel. (01)4894 339/4894 911, Fax. (01)4814 240
Hong Kong: PHILIPS HONG KONG Ltd., Components Div.,
6/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG, N.T.,
Tel. (852)424 5121, Fax. (852)428 6729
India: Philips INDIA Ltd, Components Dept,
Shivsagar Estate, A Block ,
Dr. Annie Besant Rd. Worli, Bombay 400 018
Tel. (022)4938 541, Fax. (022)4938 722
Indonesia: Philips House, Jalan H.R. Rasuna Said Kav. 3-4,
P.O. Box 4252, JAKARTA 12950,
Tel. (021)5201 122, Fax. (021)5205 189
Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. (01)640 000, Fax. (01)640 200
Italy: PHILIPS COMPONENTS S.r.l.,
Viale F. Testi, 327, 20162 MILANO,
Tel. (02)6752.3302, Fax. (02)6752 3300.
Japan: Philips Bldg 13-37, Kohnan 2 -chome, Minato-ku, TOKYO 108,
Tel. (03)3740 5028, Fax. (03)3740 0580
Korea: (Republic of) Philips House, 260-199 Itaewon-dong,
Yongsan-ku, SEOUL, Tel. (02)794-5011, Fax. (02)798-8022
Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA,
SELANGOR, Tel. (03)750 5214, Fax. (03)757 4880
Mexico: Philips Components, 5900 Gateway East, Suite 200,
EL PASO, TX 79905, Tel. 9-5(800)234-7381, Fax. (708)296-8556
Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB
Tel. (040)783749, Fax. (040)788399
New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. (09)849-4160, Fax. (09)849-7811
Norway: Box 1, Manglerud 0612, OSLO,
Tel. (022)74 8000, Fax. (022)74 8341
Pakistan: Philips Electrical Industries of Pakistan Ltd.,
Exchange Bldg. ST-2/A, Block 9, KDA Scheme 5, Clifton,
KARACHI 75600, Tel. (021)587 4641-49,
Fax. (021)577035/5874546.
Philippines: PHILIPS SEMICONDUCTORS PHILIPPINES Inc,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. (02)810 0161, Fax. (02)817 3474
Portugal: PHILIPS PORTUGUESA, S.A.,
Rua dr. António Loureiro Borges 5, Arquiparque - Miraflores,
Apartado 300, 2795 LINDA-A-VELHA,
Tel. (01)14163160/4163333, Fax. (01)14163174/4163366.
Singapore: Lorong 1, Toa Payoh, SINGAPORE 1231,
Tel. (65)350 2000, Fax. (65)251 6500
South Africa: S.A. PHILIPS Pty Ltd., Components Division,
195-215 Main Road Martindale, 2092 JOHANNESBURG,
P.O. Box 7430 Johannesburg 2000,
Tel. (011)470-5911, Fax. (011)470-5494.
Spain: Balmes 22, 08007 BARCELONA,
Tel. (03)301 6312, Fax. (03)301 42 43
Sweden: Kottbygatan 7, Akalla. S-164 85 STOCKHOLM,
Tel. (0)8-632 2000, Fax. (0)8-632 2745
Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. (01)488 2211, Fax. (01)481 77 30
Taiwan: PHILIPS TAIWAN Ltd., 23-30F, 66, Chung Hsiao West
Road, Sec. 1. Taipeh, Taiwan ROC, P.O. Box 22978,
TAIPEI 100, Tel. (02)388 7666, Fax. (02)382 4382.
Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong,
Bangkok 10260, THAILAND,
Tel. (662)398-0141, Fax. (662)398-3319.
Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. (0212)279 2770, Fax. (0212)269 3094
United Kingdom: Philips Semiconductors Limited, P.O. Box 65,
Philips House, Torrington Place, LONDON, WC1E 7HD,
Tel. (071)436 41 44, Fax. (071)323 03 42
United States: INTEGRATED CIRCUITS:
811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. (800)234-7381, Fax. (708)296-8556
DISCRETE SEMICONDUCTORS: 2001 West Blue Heron Blvd.,
P.O. Box 10330, RIVIERA BEACH, FLORIDA 33404,
Tel. (800)447-3762 and (407)881-3200, Fax. (407)881-3300
Uruguay: Coronel Mora 433, MONTEVIDEO,
Tel. (02)70-4044, Fax. (02)92 0601

For all other countries apply to: Philips Semiconductors,
International Marketing and Sales, Building BAF-1,
P.O. Box 218, 5600 MD, EINDHOVEN, The Netherlands,
Telex 35000 phtcnl, Fax. +31-40-724825

Printed in The Netherlands

123065/1500/02/pp12 Date of release: June 1994

Document order number: 9397 733 10011

Philips Semiconductors

PHILIPS